

Comm.  
Dr. Gardner  
Dr. Loosli  
Dr. Wyatt

CHRONIC PULMONARY DISEASES

#7423

**THE COUNCIL FOR TOBACCO RESEARCH-U.S.A., INC.**

110 EAST 50TH STREET  
NEW YORK, N. Y. 10022  
(212) 421-8845

Application for Research Grant  
(Use extra pages as needed)

JUN 19 1973

Date: June 2nd, 1973.

1. Principal Investigator (give title and degrees).  
- Lauweryns, Joseph-M., M.D., Ph.D., Professor Ordinarius in Microscopic Anatomy and Pathology ; Chairman, Principal Investigator.
2. Institution & address:  
Experimental Laboratory of Cardiopulmonary and Genital Pathology, Department of Pathology, University of Leuven, 12, Minderbroedersstraat, B - 3000 LEUVEN-BELGIUM.
3. Department(s) where research will be done or collaboration provided:  
Experimental Laboratory of Cardiopulmonary and Genital Pathology, department of Pathology, University of Leuven, 12, Minderbroedersstraat, B - 3000 LEUVEN-BELGIUM.
4. Short title of study:  
The lymphatics of the lung. Their role in fluid transport and clearance of airborne particulate matter in normal and experimental conditions and in various lung diseases.
5. Proposed starting date. January 1, 1974 (first continuation or renewal application)
6. Estimated time to complete: From January 1, 1973 till December 31st, 1975.
7. Brief description of specific research aims.  
Despite our experience in the proposed field of investigation, numerous aspects of the structure and function of the pulmonary lymphatics are still either largely unknown or a matter of considerable controversy in the literature. Each technique of study having its shortcomings, these can only be solved accurately by a further and multidisciplinary investigation of the pulmonary lymphatics which will include various techniques, i.e. - anatomical injection studies, - stereomicroscopical studies, - serial reconstructions, - radiography and microradiography, - histological techniques, - morphometrical techniques, - histochemical techniques, - transmission electron microscopy, freeze-etching electron microscopy and scanning electron microscopy.  
During the three years of this research proposal we intend to study the pulmonary lymphatics - with the techniques proposed - along three major lines of investigation:  
- (1) normal morphology of the pulmonary lymphatics, - (2) an experimental study of the various morphological factors involved in the clearance and lymphatic drainage of the lung parenchyma, - (3) and morphological studies of the lung lymphatics in various pathological conditions especially in such cases where the formation of lung edema is observed (e.g. neonatal lungs : hyaline membrane disease ; adult lungs : pulmonary edema, especially when associated with chronic respiratory insufficiency as in chronic bronchitis or emphysema, shock lungs (cardiogenic and neurogenic), uremia, drowning..).  
Though the lines of investigation are distinct, the study object (i.e. the lymphatics) is identical and the results interrelated.  
These studies will necessarily end in important and original contributions which will have many basic and applied results in the structure and function of the normal and diseased lung. It is obvious that these studies are of immediate and relevant importance in biological tobacco research.

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8. Brief statement of working hypothesis:

2.

A combined and multidisciplinary morphological investigation by a team of investigators working closely together since several years, will allow to avoid the shortcomings of each individual technique of investigation in lymphatic research. Studies of pulmonary fluid transport and of airborne particulate matter in normal and diseased lungs and in experimental conditions urgently request a precise and up-to-date knowledge of the pulmonary lymphatics, which is still lacking.

9. Details of experimental design and procedures (append extra pages as necessary)

See separate pages - Addendum 1.

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## 10. Space and facilities available (when elsewhere than item 2 indicates, state location):

- All physical facilities are available at our laboratory (as mentioned under item 2), except a scanning electron microscope. As the purchase of a scanning electron microscope has not been funded on the budget of our present CTR-grant (see former application), we carry out this aspect of our work - as earlier - at the University of Ghent, Central Laboratory of Electron microscopy, Chairman Prof. A. LAGASSE, St. Pietersnieuwstraat 41, B - 9000 GHEENT - Belgium.
- Separate list of these physical facilities - see addendum 2

## 11. Additional facilities required.

- As the proposed purchase of a scanning electron microscope was not funded on our earlier CTR-application, we do propose to continue this aspect of our research program at the University of Ghent (see item 10).
- Hence no additional facilities are requested.

i.e. - Lauweryns, Joseph-M., M.D., Ph.D., principal investigator  
 - Boussauw, Luc, Lic. Biol. Sc., full-time research assistant, doctorandus. Co-investigator.  
 - Desmecht, Monique, (Mrs. Gombeer), Lic. Biol. Sc., full-time research assistant. Co-investigator.

## 12. Biographical sketches of investigator(s) and other professional personnel (append):

See separate pages - Addendum 3

## 13. Publications. (five most recent and pertinent of investigator(s); append list, and provide reprints if available).

Publications and Progress Report - see separate pages - Addendum 4.

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## 14. First year budget:

\*A. Salaries (give names or state "to be recruited")  
Professional (give % time of investigator(s)  
even if no salary requested)

% time

Amount

- Lauweryns Joseph

60 %

- Boussauw Luc

90 %

- Desmecht Monique

90 %

R

## Technical

- Two laboratory technicians

100 %

(Agnes Thijs ; Ons Stefaan).

R

Sub-Total for A

R

## B. Consumable supplies (by major categories)

Animals

2.260

Supplies

10.000

Sub-Total for B

12.260

## C. Other expenses (itemize)

Sub-Total for C

none

Running Total of A + B + C

24.556

## D. Permanent equipment (itemize)

Sub-Total for D

none

E

none

Total request

24.556

## E. Indirect costs (15% of A+B+C)

## 15. Estimated future requirements:

	Salaries	Consumable Suppl.	Other Expenses	Permanent Equip.	Indirect Costs	Total
Year 2	as detailed above					
Year 3	R	13.520				27.016

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5.

## 16. Other sources of financial support

List financial support from all sources, including own institution, for this and related research projects.

CURRENTLY ACTIVE			
Title of Project	Source (give grant numbers)	Amount	Inclusive Dates
Morphological studies of the lung.	University of Leuven	REDACTED	
	J.M. Lauweryns, Professor salary		yearly
	L. Boussauw, assistant, salary		yearly
	M. Desmecht, assistant, salary		early
	Salary of 2 technicians		arly
	Supplies and animals		arly
PENDING OR PLANNED			
Title of Project	Source (give grant numbers)	Amount	Inclusive Dates
	none		

It is understood that the investigator and institutional officers in applying for a grant have read and accept the Council's "Statement of Policy Containing Conditions and Terms Under Which Project Grants Are Made."

Principal investigator

Typed Name Joseph M. LAUWERYNS,Signature *J. M. Lauweryns* Date June 2nd, 73.Telephone R Area Code          Number          Extension         

Checks payable to

Prof. P. DE SOMER, Rector of the University.

Mailing address for checks

Dr. P. DE SOMER, Rector, Catholic  
University of Leuven,  
B - 3000 LEUVEN - BELGIUM

Responsible officer of institution

Typed Name Pieter DE SOMERTitle RectorSignature *P. De Somer* Date June 10th '73Telephone R Area Code          Number          Extension         

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ADDENDUM 1

9. DETAILS OF EXPERIMENTAL DESIGN AND PROCEDURES

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THE EFFECTS OF THE LYMPHATIC SYSTEM IN THE PATHOLOGY  
AND CLINICAL OF ANGIOGENESIS IN NORMAL  
AND EXPERIMENTAL CONDITIONS AND IN VARIOUS DISEASES

DETAILS OF EXPERIMENTAL DESIGN AND PROCEDURES, POSTER PLAN

A. INTRODUCTION AND SPECIFIC AIMS

(1) Literature

1.1. As regards the normal morphology of the pulmonary lymphatic system a considerable interest has developed in recent years and much time and efforts have been spent in the study of its structure and function. Especially in the morphological field and following injection studies (Lauweryns et al., publication nr. (26), 1962, (33), 1965, (69), 1970, (89), 1971, Pennell, 1966, Pump, 1970, Trapnell, 1963, Bastianini, 1967, a,b), histological (Lauweryns et al., publication nr. (31), 1963, (34), 1964, (36), 1964, (37), 1965, (46), 1966, (60), 1968, (85), 1970, (86), 1970, (121), 1972, Aminova, 1963, 1967, Grau, 1965, Jdanov, 1969, Karpe, 1965, Kriz, 1970, Oehmeke, 1968), histochemical (Borst et al., 1969, Fruschelli, 1967, 1966), radiological (Pennell, 1966, Trapnell, 1963, Lauweryns et al., publication nr. (26), 1962, (34), 1964, (69), 1970, (96), 1971) and especially electron microscopic (Borst et al., 1969, Lauweryns et al., publication nr. (57), 1968, (88), 1970, (96), 1971, (115), 1971, (124), 1972, (125), 1972, Casley-Smith, 1961, 1967, Cliff, 1970, Collan et al., 1970, Fruschelli, 1970, Kato, 1966 a, 1966 b, Klika, 1963, Kriz, 1970, Kühnel, 1966, Leak, 1966, 1967, 1968, 1968, 1970) Oehmeke, 1968, Schipp, 1967, 1968, Takada, 1971, Vajda, 1971, Viragh, 1966) investigations of the lymphatic vessels of several body regions, important discoveries have been made, which have led in turn to new ideas and hypothesis concerning the functioning of the lymphatic system. In this way the existence of open junctions (Leak, 1965, 1966, 1968, 1968, 1971, Casley-Smith, 1961, 1967, 1969) and of anchoring filaments (Leak, 1966, 1967, 1968) led to the flap valve concept of the endothelial junctions (Collan, 1970). The absence of a continuous basement membrane and the presence of open junctions and cytoplasmic vesicles (Casley-Smith, 1969) explained the high permeability of the lymphatic endothelium. The presence of filaments within the lymphatic endothelial cells suggests that these cells might have an active and contractile role (Kajno, 1969, Schipp, 1968). The recovery of important amount of tracer proteins (Leak, 1970, 1971, Földi, 1955) in the lymphatic endothelium suggests that these cells might have phagocytotic properties. The ultrastructural aspect and composition of lymphatic valves also raised important ideas about their functioning (Lauweryns et al., (85), 1970, (104), 1970, (96), 1971, (115), 1971, Vajda and Tomcsik, 1971).

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Our investigations were directed almost exclusively towards the physiology of the lung for several reasons. First of all, we were struck by the contradiction between the idea that the pulmonary tissue was a "dry" tissue in which no lymph was formed, as a consequence of the low pressure of the pulmonary circulation (Fick, 1964) on the one hand, and the very extensive pulmonary lymphatic plexus on the other hand (Lauweryns, publication nr. (35) 1960, (215) 1961).

Secondly we realized the importance of the pulmonary lymphatic system at birth, when the fluid contents of the pulmonary capillaries and alveoli is apparently largely and very quickly removed via the pulmonary lymphatics (Aherne and Dawkins, 1964, Boston, 1965, Humphreys et al., 1967). Failure of this removal is somehow related to the hyaline membrane disease (Lauweryns et al., publication nr. (38), 1965, (39), 1965, (56), 1968, (70), 1968, (74), 1968, (76), 1968, (80), 1969, (88), 1970) or the idiopathic respiratory distress<sup>syndrome</sup> of the newborn, a disease responsible for a large percentage of neonatal deaths (Avery, 1964). Finally the importance of the pulmonary lymphatic system for the efficiency and well functioning of respiration and vice versa is gradually becoming clear (Maier, 1966).

Our efforts were successful and we were able to extend the knowledge obtained mainly from lymphatics from skin and mesenterium (Boret, 1969, Casley-Smith, 1961, 1967, Cliff, 1970, Leak and Burke, 1968, Oclake, 1968, Okuma, 1970, Schipp, 1968) and to compare them to the pulmonary lymphatics; to confirm various aspects of their structure and to contribute with several important discoveries, such as the juxta-alveolar lymphatics and the pericentriolar filamentous bundles (Lauweryns et al., publication nr. (38), 1965, (56), 1968, (57), 1968, (60), 1968, (69), 1970), (70), 1968, (74), 1968, (76), 1968, (80), 1969, (85), 1970, (86), 1970, (104), 1970, (121), 1972, (124), (125), Lauweryns, publication nr. (26), 1962, (31), 1963, (34), 1964, (36), 1964, (37), 1965, (39), 1965, (46), 1966, (58), 1970, (89), 1971, (96), 1971, (115), 1971).

1.2. As regards an experimental approach of the various morphological factors involved in the clearance and drainage of the lung parenchyma, we have summarized the available data of the literature on the hereby included scheme 1.

A simple glance at this scheme<sup>1</sup> reveals that :

- no morphological data are available on the precise mechanisms of lymphatic lung drainage (except for the light optical tracer studies of Casarett et al., 1964), and that

- much contradiction exists as to the results obtained, e.g. in the all or not phagocytotic properties of the type I and type II alveolar epithelial cells, even when the investigators have used the same tracer substance (see scheme 1 for thorotrast, carbon and chinese India Ink studies).



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SCHEM I

BRINKMAN a.s. 1957	-	dog	bovine protein in saline	intratracheal injection		+		
CO. 1900 and SILVERMAN, 1949	-	rabbit	silicium	intratracheal injection	9 h.			
SEAL and STAFFORD, 1951	-	dog	various ions	intratracheal injection				
COLES and HAGELBERG, 1954	+ (LO)	rat	India ink	intratracheal injection	4 h. 24 d.	+	+	+
LOW and SALT- PAJO, 1957	+ (LO)	rat	thorotrast	intratracheal injection	1/2 h.		+	
CLECHING, 1952	+ (LO)	rat	barium-hydrox carbon gold iron-oxigen India ink	intratracheal injection	10 min. to 6 w.		+	+
KA. R, 1958	+ (LO)	mouse	India ink	intratracheal injection	1 1/2 h.		+	
POLIGARD a.s. 1959	+ (LO)	rat	silicium	intratracheal injection			+	
KARBER, 1960	+ (LO)	mouse	India ink	intratracheal injection	2 h. & 1 d. 9 d.		+	+
ST. M. C. a.s. 1961	-	dog	$^{131}\text{I}$ albumin- $^{131}\text{I}$	intratracheal injection	1 h. 3144h 1 h. 3144h	+		
CASARIT, 1964	+ (LO)	rat	Polonium-210	inhalation			+	
CASARIT and MILLEY, 1964	+ (LO)	rabbit	$^{210}\text{Po}(\text{OH})_2$ / $^{239}\text{PuO}_2$	inhalation			+	
CASARIT and MILLEY, 1964	+ (LO)	rabbit	$^{210}\text{Po}(\text{OH})_2$ $^{210}\text{Po}$ colloid tagged silver	intratracheal injection	1 & 30 d. 1 & 28 d.		+	
SCHULTZ a.s. 1964	-	isolated lung of dog	albumin- $^{131}\text{I}$	intratracheal injection	1 h. 5 h. 1 h. 24 h			
LADMAN and FINLEY, 1966	+ (LO)	dog	thorotrast	incubation of alveolar wash	1/2 h.			
ECNSCH a.s. 1967	-	dog	$^{131}\text{I}$ -albumin $^{131}\text{I}$ -globulin	intratracheal injection	15 m. & 7 d.			
DOVINGUEZ a.s. 1967	-	guinea pig dog	albumin polyvinylpyr- rolidone	intratracheal injection	1/2 h 45h 3 & 5 d.	+		
RIDEN, 1967	+ (LO)	mouse	carbon	inhalation	1/2 h.			
CASEY and PHELPS, 1968	+ (LO)	rat	polonium-210	inhalation			+	

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-	-		-				-				
+	+			+							
+	+			+							
	+	-	+		+	+	+			?	
-	-										
-	+										
	+										
-	+		+		+		+				
+	+										
-	+	-	+				+				
-	+	-	+		+	+	+				

#### LEGEND

Type II Cell : Type II alveolar epithelial Cell

Type I Cell : Type I alveolar epithelial Cell

Epith. Junct. : Epithelial Junction

Interstitium : Basement Membrane and Interstitium

Conn. Tissue : Connective Tissue Cell

End. EV. : Endothelial Cells of Blood Vessels

End. EV. Junct. : Endothelial Junctions of Blood Vessels

Lum. EV. : Lumen of Blood Vessels

Endoth. Lymph. : Endothelial Cells of Lymphatics

End. L. Junct. : Endothelial Junctions of Lymphatics

Lum. Lym. : Lumen of Lymphatics

Lym. Node : Lymph Node

?<sup>HE</sup> : not demonstrated ; hypothetically formulated

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About one year ago (see progress report -) we have started an experimental study in this respect (using ferritin as a tracer), and it is obvious (Lauweryns and collaborators, unpublished data) that a careful experimental investigation using various morphological techniques and considering the newest literature data on lung structure and function, will yield new and basic results.

1.3. As regards morphological studies of the lung lymphatics in various pathological conditions of the lung parenchyma, it may be stated that no real data are available in the literature, except for casual annotations and our earlier histological (Lauweryns et al., publication nr. (38), 1965, (39), 1965) and morphometrical (Lauweryns et al., publication nr. (56), 1968, (80), 1969) studies on the lung lymphatics in neonatal hyaline membrane disease (76), 1965, (38), 1970) and in drowning (Lauweryns, (92), 1970).

Still the formation of lung edema occurs daily in medical practice in a large number of patients, in association e.g. with chronic and progressive respiratory insufficiency as in chronic bronchitis or emphysema, shock lungs (cardiogenic and neurogenic), uremia, drowning...

It does not seem believable that (almost) nothing is known about the fine morphology of the lung lymphatics in diseased and edematous lungs.

## (2) Aims and rationale

From the foregoing we feel that our studies on the lymphatics of the lung should be carried on, as they are not only basically important but are also directed to understand the diseased lung better.

The aims of the proposed study are indeed :

2.1. A further and thorough morphological investigation of the lymphatic system of normal lungs, i.e.

- High power electron microscopy and enzyme digestion studies of anchoring and endothelial filaments.
- Comparative electron microscopic investigations of capillaries, collecting ducts and conducting channels in various animal species and body localizations.
- Electron microscopic and scanning electron microscopic studies of the "roots" of the pulmonary lymphatic system and the valves.
- The innervation of the lung lymphatics.

2.2. An experimental approach of the various morphological factors (especially the lymphatics) involved in the clearance and drainage of the lung parenchyma of airborne particulate matter.

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2.3. A morphological study of the lymphatic system in various diseases (chronic progressive pulmonary insufficiency in chronic bronchitis or emphysema, acute lungs (neoplastic or non-neoplastic), cancer, etc.).

These three areas 2.1., 2.2. and 2.3. will be investigated in parallel during the three years of our research proposal.

#### 2.1. Morphology of the pulmonary lymphatic system

The most urgent questions to be solved in this field are :

##### 2.1.a. The nature and the function of the anchoring filaments.

As it is up to now virtually impossible to isolate these filaments and to submit them to chemical analysis, their nature and function might perhaps be discovered by a high resolution EM in order to compare them with other well known filaments like actin, myosin, protocollagen, combined with enzyme (hyaluronidase, elastase,...) digestion studies. One may also wonder about the nature and the function of the filaments situated within the lymphatic endothelial cells (Cecio, 1967). In a similar way high power electron microscopy for comparative reasons combined with enzyme digestion methods and the study of their morphological reaction towards pharmacological agents might reveal their nature and function.

2.1.b. The nature and the function of the very recently discovered pericentriolar filamentous bundles (Lauweryns et al., (124), (125), in press). A study of their distribution in different cell types and in various animal species might at least reveal whether they are specific to some animals, to some cell types and might hence suggest possible roles. If they were specific to lymphatic endothelium and present in various species, their role would certainly be related to lymphatic function.

2.1.c. The endings of the pulmonary lymphatic system. Are the terminal divisions of the small lymphatic capillaries (the initial lymphatics, Caeley-Smith, 1961) blind fingerlike projections, on themselves closed loops, or is there fine communication with tissue clefts (Klika, 1968) ? This problem can best be studied by the use of electron microscopic techniques which allow a certain degree of tridimensional visualization and surface view, i.e. freeze-etching and especially scanning electron microscopy.

2.1.d. The pulmonary lymphatic valves. Our graphic reconstructions (Lauweryns et al., publication nr. (85), 1970, (86), 1970, (89), 1971, (96), 1971, (121), 1972) and stereomicroscopic observations (Lauweryns, publication nr. (111), 1971, (115), 1971) of pulmonary lymphatic valves could most adequately be confirmed and extended by scanning electron microscopy of these valves.

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2.1.e. The morphological differences between lymphatic and blood vessels.  
collecting channels and efferent channels. It is hardly believable that no data are known concerning this subject. The answer to this question implies a thorough electron microscopical and histological observation of a large number of lymphatics in various localisations and in various animals.

2.1.f. The innervation of the lymphatics and their valves.  
(Collert, 1967, Kubik, 1955, Melnikova, 1964, Schipp, 1965, Shdanov, 1967, Vajda, 1966). Here a combined neurohistochemical and electron microscopic investigation will we have executed in other areas (Lauweryns et al., publication nr. (84), 1969, (106), 1970, (108), 1971, (117), 1972) - will lead to an answer.

Rationale : These various morphological problems are to some extent related and can also only be accurately solved (Lauweryns et al., publication nr. (86), 1969, (96), 1971) by a combined and multidisciplinary approach including various techniques, which are familiar to us, i.e.; : - anatomical injection studies, - serial reconstructions, - radiography and microradiography, - histological techniques, - morphometrical studies, - histochemical techniques and - electron microscopy.

All these techniques currently used at our laboratory have indeed their limitations, and some of them could even produce artefacts. Injection of the lymphatics of the pleura i.e. with radioopaque substances followed by radiography, or with plastic substances followed by corrosion of the tissues, easily causes disruption of the delicate walls of the smaller lymphatic vessels and filling of tissue clefts. The injection moreover may inverse valves and hence result in false pictures of lymphatic drainage-pathways. Corrosion casts and radiographs moreover do not reveal the relationship of the vessels to the surrounding tissues in fine detail.

Histological examination i.e. of non injected lymphatics is hindered by difficulties in recognizing pulmonary lymphatic capillaries and in differentiating them with certitude from small blood vessels and tissue clefts. Histochemical methods to differentiate lymphatic vessels from other structures are not known.

Reconstructions from serial histological sections (Staubesand et al., 1953, Comparini et al., 1965, Boussauw et al., publication nr. (85), 1970) are subject to the same difficulties and have moreover the disadvantage of being a time consuming procedure.

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Electronmicroscopy is also limited because only very small areas can be investigated.

Freeze-etching electron microscopy will also be applied. This technique is different from traditional electron microscopy because it avoids some chemical interactions in the tissues, exposes tissue structures in relief and allows the observation of membrane surfaces "en face". We are thoroughly acquainted with



this technique, but the study does contain information on the lymphatic system (Lauweryns et al., publication nr. (95), 1971, (97), 1971, (100), 1971, (101), submitted). In studying the lymphatics, it still poses one major problem as basal membranes are not visible on freeze-etch electron micrographs (hence hindering the differentiation from lymphatic capillaries with other small vessels or even tissue clefts).

Scanning electron microscopy will also be executed. It will certainly add important information and new, original and unique data to our field of study; indeed it allows the investigation of relatively large samples (as compared to transmission electron microscopy) both at low and higher magnification and with great focal depth. Moreover the peculiar tridimensional "geometrical" structure of the lung seems to be ideally adapted for SEM investigation.

From the limitations and inherent risks of each of these methods, we feel that only a multidisciplinary investigation by applying various methods of investigation can result in a clear, synthetic and true picture of the pulmonary lymphatic system, as already stands out from our earlier work (Lauweryns et al., publication nr. (26), 1962, (31), 1963, (34), 1964, (36), 1964, (37), 1965, (38), 1965, (39), 1965, (46), 1966, (56), 1968, (57), 1968, (60), 1968, (69), 1970, (70), 1968, (74), 1968, (76), 1968, (80), 1969, (84), 1969, (85), 1969, (86), 1970, (88), 1970, (89), 1971, (96), 1971, (104), 1970, (106), 1970, (108), 1971, (111), 1971, (115), 1971, (117), 1972, (121), 1972, (124) & (125) in press).

## 2.2. Experimental study of the various morphological factors (especially the lymphatics) involved in fluid transport and clearance of particulate matter

Following the pathway(s) which free particles have to follow to reach the lymphatic capillary lumen from the alveolar lumen, the following factors have to be considered: - alveolar macrophages, - alveolar epithelium, - basal membrane(s), - alveolar interstitium with blood capillaries, - lymphatic endothelium.

2.2.a. The alveolar macrophages, whose origin is seriously controverted (Bertalauffy and Leblond, 1953, Karrer, 1960, Bowden et al., 1963, Pinkett et al., 1966) do represent an important factor in alveolar clearance (Karrer, 1958, Policard et al., 1959, Faulkner and Esterly, 1969, Sanders and Adey, 1970). They are sometimes aided in their task by leucocytes which may be present in the alveolar lumen as free cells (Gross and Westrick, 1954, Giesecking, 1958, Karrer, 1960, Suzuki and Churg, 1969, Faulkner and Esterly, 1969). After resorption of foreign material the macrophages may (Cole, 1944, Vorwald, 1950, Karrer, 1960, Davies, 1963) or may not (Gross and Hatch, 1962, Hatch and Gross, 1964, Casarett and Milley, 1964) migrate to the interstitium and further on to the lymphatics.

These different aspects should be investigated.

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2.2.b. The phagocytic properties of the alveolar epithelium - as clearly demonstrated in table 1, content of macrophages within the alveolar structure concerning the phagocytotic properties of the alveolar epithelium; this problem is not only important as such, but also because it remains related to the cellular origin of the surfactant (Shacklin, 1957; Mikawa et al., 1965; Niden, 1967; Kohn, 1968; Azopardi and Thurlbeck, 1969; Bannex, 1970).

2.2.c. The permeability of the basal membrane(s) which are not observed on freeze-etching electron micrographs (Lauweryns et al., publication nr. (95), 1971, (97), 1971, (100), 1971, (123) submitted; Friederici, 1968), also remains an open question (Schneeberger-Kenley and Karnovsky, 1968).

Precise studies with high resolution electron microscopy on the fate and migration of particles through the interstitium and their interaction with the connective tissue cells have also not been executed.

2.2.d. The way(s) by which particles enter the lymphatic lumen is mainly speculative (Nappleston, 1963). An intercellular transport via typical open junctions is usually accepted (Lauweryns et al., publication nr. (73), 1969), still a transcellular transport may occur as well (Casley-Smith, 1965; Leak and Burke, 1968).

It is also unsettled if the lymphatic endothelial lining cells are capable of storing, digesting or transporting particles?

The same question may be asked concerning the blood capillaries.

Though both vessel systems (blood- and lymph vessels) probably play a role in alveolar clearance, their relative importance remains unsettled (Mayer et al., 1969; Derner, 1970 b, Leak, 1970, 1971).

Rationale : Though using in general terms the same spectrum of techniques, as mentioned under 2.1., this investigation will be mainly electron microscopical.

### 2.3. The lung lymphatics in various diseases

Being thoroughly acquainted with the lymphatics in the normal adult and infant lung and having approached them already in two diseases (i.e. Hyaline Membrane Disease of the human newborn (Lauweryns et al., publication nr. (38), 1965, (39), 1965, (56), 1968, (76), 1968, (80), 1969, (88), 1970) and drowning (Lauweryns, publication nr. (92), 1970), we propose to investigate them in various diseases (chronic and progressive respiratory insufficiency as in chronic bronchitis or emphysema, shock lungs (cardiogenic and neurogenic), uremia, drowning, hyaline membrane disease, lungs of other neonatal deaths), especially when these are accompanied with edema formation.

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As practically nothing is known about this subject, it will require a considerable task and constitute quite an endeavor ; it is however obvious that we are ideally prepared to investigate this challenging problem, being thoroughly acquainted with the normal anatomy of the lymphatics and being indeed an a pathologist.

Rationale : Gross (including lymphatic injections) and routine microscopic studies (including morphometric pilot studies) of the lungs will be first undertaken. Depending on the obtained results further investigations (transmission electron microscopical, scanning electron microscopical, freeze-etching) will be further undertaken.

## b. METHODS OF PROCEDURE

### (1) Species to be investigated

#### 1.1. As regards the normal morphology of the pulmonary lymphatic system :

- rabbit (newborn and adult).
- human infant and adult lungs.

We are thoroughly acquainted with rabbit and human lungs, as we are studying them since 1953 (cfr. curriculum vitae).

#### 1.2. As regards the experimental study :

- newborn rabbits.

We are indeed not only thoroughly acquainted with their lungs, but have already undertaken these experiments since one year with satisfactory results.

#### 1.3. As regards the lung lymphatics in various diseases :

There will be no problem of collecting lungs as we have currently about 120 infant and 350 adult postmortems yearly.

As regards electron microscopy, we have no problem to be immediately alerted and do the fixations as soon as possible ; we are indeed immediately informed by the "Newborn premature center", the "High care unit" and the "Clinic for chronic lung diseases". The efficiency of this delicate cooperation has been demonstrated in our earlier electron microscopical studies of "Hyaline Membrane Disease" and human "Lung Lymphatics" in normal lungs (cfr. publications - curriculum vitae).

It is clear from the above that we will have no problems to harvest the lungs needed for our investigation.

### (2) Techniques to be applied to :

#### 2.1. Normal morphology of the pulmonary lymphatic system :

The techniques to be applied are all familiar to us (enzyme digestion excepted). They are especially :

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- high power electron microscopy (problems 2.1.b ; 2.1.c ; 2.1.d ; 2.1.e).
- high power electron microscopy and computerized image analysis (problems 2.1.b ; 2.1.c ; 2.1.d ; 2.1.e).
- freeze-etching electron microscopy (problems 2.1.d ; 2.1.e).
- scanning electron microscopy (problems 2.1.d ; 2.1.e).
- electron microscopy (problems 2.1.b ; 2.1.e).

As regards the innervation of the pulmonary lymphatics, will be studied by the classical histological techniques of silver impregnation (Gordon-Watson-Campbell), by histochemical studies on cholinesterases (method of Loelle, modified by Gerebáczoff (1959) and by freeze-drying-fluorescent studies on catecholamines (method of Falck, 1962, 1965). We are thoroughly acquainted with these techniques (cfr. Lauweryns et al., publication nr. (53), 1967, (64), 1969, (84), 1969, (103), 1970, (117), 1972).

For a distinction of cholinergic and adrenergic nerve endings we will apply the methods of Richardson (1966), De Robertis and Pellegrino, Wood and Barnett, (1964). Here also high resolution electron microscopy is best applied.

## 2.2. Experimental study :

- This will be the continuation of our study, started about one year ago. Under slight anesthesia, a tracer (0,05 cc) will be intratracheally instilled. Instillation causes indeed much less tissue disturbance or damage than injection. The amount of tracer introduced in the lungs by this procedure is also constant ; this is not true in cases of intranasal instillation.

- The animals are killed at various intervals after the instillation (from 15 min. to 24 days) and a careful electron microscopical investigation of both lungs carried out.

- Morphometric studies will be carried out to estimate the removal of the tracer and its fine localization in the lung.

- As tracer we will first use a colloidal solution of ferritin ( $\approx 100$  Å 110 Å, MW  $\pm 465000$ , 2 Å crystalline, cadmium free, N.B.C., Cleveland) ; Indeed ferritin is not only a widely used and efficient tracer (biological protein, electrondense, non-toxic, Bruns and Palade, 1968) but has also never been used in an analogous study.

- To check the probable influence of the physico-chemical properties of the tracer ferritin, we will next use a totally different tracer, i.e. a carbon suspension (C11/1431 a; Günther Wagner, Hanover) whose composition has been described by Biozzi et al., (1953).

- Both series of results will be compared.

- After these studies using ferritin and a carbon suspension, other tracers could be used, if necessary (i.e. horseradish peroxidase ; thorotrast ; colloidal gold ; etc).

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### 2.3. The lymphatics in various diseases :

As this constitutes an entirely new investigation with no reliable literature data available, we will apply the whole spectrum of morphological techniques which we have used earlier to study the lymphatics in normal lungs. Indeed and as explained in Rationale 2.1., each technique having its shortcomings, a combined and multidisciplinary approach is inevitable including various methods, which are familiar to us : - anatomical injection studies, - serial reconstruction, - radiography and microradiography, - histological techniques, - morphometrical techniques, - histochemical techniques, - transmission electron microscopy, - freeze-etching electron microscopy and scanning electron microscopy.

The "pilot approach" will include detailed gross and microscopic studies, combined with some injection studies and elementary morphometry.

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1. AMELINA V., KOLMAN I.S. : - The permeability of blood vessels after birth in the rabbit, and the effect on this of pulmonary and pre-natal hypoxia.  
MOON. MAGAZ., 1978, 7 : 224-229.
2. AMELINA G.G. : - The endothelium of the lymphatic capillaries and vessels of the diaphragm in rabbits.  
ARH. ANAT. GISTOL. EMEROL., 1953, 44 : 81-90.
3. AMELINA G.G. : - Endothelium of lymphatic capillaries and vessels of the central tendineum of the rabbit diaphragm in pre- and postnatal developmental periods.  
ARH. ANAT. GISTOL. EMEROL., 1957, 53 : 64-71.
4. AZZOPARDI A., THURLECK W.M. : - The histochemistry of the nonciliated bronchiolar epithelial cell.  
AM. REV. RESP. DIS., 1959, 99 : 516-525.
5. EENSCH K.G., DOMINGUEZ E., LIEBOW A.A. : - Absorption of intact protein molecules across the pulmonary air-tissue barrier.  
SCIENCE, 1957, 127 : 1204-1205.
6. EENSCH K.G., DOMINGUEZ E. : - Studies on the pulmonary air-tissue barrier. IV. Cytochemical tracing of macromolecules during absorption.  
YALE J. BIOL. MED., 1971, 43 : 235-241.
7. EERTALANEN P.D., MELFORD C.P. : - The continuous renewal of the two types of alveolar cells in the lung of the rat.  
ANAT. REC., 1953, 115 : 515-541.
8. BLOZZI G., ENACIETRAF B., HALPERN B.N. : - Quantitative study of the granulopoietic activity of the reticulo-endothelial system. II. A study of the kinetics of the granulopoietic activity of the R.E.S. in relation to the dose of carbon injected. Relationship between the weight of the organs and their activity.  
BRIT. J. EXP. PATH., 1953, 34 : 441-457.
9. BONST R.H., MARX M., SCHMIDT W., KLEINMANN M. : - Elektronenmikroskopische und Enzyghistochemische Befunde an ableitende Lymphgefäßen in Dünndarmmesenterium der Ratte.  
Z. Zell., 1959, 101 : 353-354.
10. BOWDEN, D.H., DAVIES E., WEAVER J.P. : - Cytochemistry of pulmonary alveolar cells in the mouse.  
ARCH. PATH., 1958, 65 : 667-670.

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11. FLETCHER R.P., DAVIES J.M. : - Distribution and excretion of Polonium-210. IX. Distribution of Polonium-210 in the lungs of the rat after intratracheal administration.
12. CASARETT L.J. : - Distribution and excretion of Polonium-210. IX. Distribution of Polonium-210 in the lungs of the rat after intratracheal administration.
13. CASARETT L.J., KELLY P.S. : - Alveolar sensitivity following inhalation of particles.
14. CASARETT L.J., KOPPEL P.E. : - Distribution and excretion of Polonium-210. XI. Autoradiographic studies after intratracheal administration in the rabbit.
15. CASLEY-SMITH J.R., FLOREY H.W. : - The structure of normal small lymphatics.
16. CASLEY-SMITH J.R. : - Endothelial permeability. II. The passage of particles through the lymphatic endothelium of normal and injured ears.
17. CASLEY-SMITH J.R. : Electron microscopical observations on the dilated lymphatics in oedematous regions and their collapse following hyaluronidase administration.
18. CASLEY-SMITH J.R. : - The dimensions and numbers of small vesicles in cells, endothelial and mesothelial and the significance of these for endothelial permeability.
19. CASLEY-SMITH J.R. : - The structure of normal large lymphatics : how this determines their permeabilities and their ability to transport lymph.
20. CECIO A. : - Ultrastructural features of cytofilaments within mammalian endothelial cells.
21. CLIFF V.J., NICOLL P.A. : - Structure and function of lymphatic vessels of the bat's wing.
22. COLE L.G. : - Pneumoconiosis. The story of dusty lungs.

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23. GORDON J., PETERSON R.A. : - The alveolar wall of the ferret. A light and electron microscopical study.  
 J. EXP. MED., 1970, 131 : 357-366.
24. GORDON J. : - Morphologic potential of pulmonary alveolar epithelium, with special reference to surfactant metabolism.  
 ANATOMY, 1970, 25 : 110-115.
25. GORDON J.C., SHERMAN U.J. : - Absorption from the lungs.  
 J. EXP. MED., 1970, 131 : 105-116.
26. GORDON J.C. : - Lymph flow in the lungs.  
 BRIT. MED. J., 1965, 19 : 76-79.
27. DAVIES C.H. : - The handling of particles by the human lung.  
 BRIT. MED. J., 1965, 19 : 49-52.
28. DEMPSEY G.B. : - The pulmonary surfactant content of the inclusion bodies found within type II alveolar cells.  
 J. ULTRASTR. RES., 1970, 33 : 305-317.
29. DEMPSEY G.B. : - The fixation of pulmonary surfactant for microscopy. II. Transport of surfactant through the air-blood barrier.  
 J. ULTRASTR. RES. 1970(a), 31 : 229-246.
30. DOMINGUEZ E.A., LEECH A.A., LEECH K.G. : - Studies on the pulmonary air-tissue barrier. I. Absorption of albumin by the alveolar wall.  
 LAB. INVEST., 1967, 16 : 905-911.
31. DRINKER C.K., WARREN H.F., MACLANAHAN M. : - The absorption of protein solutions from the pulmonary alveoli.  
 J. EXP. MED., 1957, 66 : 449.
32. DRINKER C.K., HARDEBERGER E. : - Absorption from pulmonary alveoli.  
 J. EXP. MED., 1947, 86 : 7-17.
33. ESTERLY J.R., FAULKNER C.S. : - The granular pneumocyte. Absence of phagocytic activity.  
 AM. REV. RES. DIS., 1970, 101 : 869-876.
34. FAULKNER C.S., ESTERLY J.R. : - Phagocytosis in the lung : distinction between the granular pneumocyte and the macrophage.  
 AM. J. PATH., 1969, 55 : 43a-44a.
35. FOLDI M., JELLINEK M., RUSZNYAK I. - SZABO G. : - Eiweiss-speicherung in den Endothelzellen der Lymphkapillaren.  
 ACTA MED. ACAD. SCI. HUNG., 1955, 7 : 211-214.
36. FRIEDRICH H.H.R. : - Freeze-etch observations on interstitial connective tissue.  
 J. ULTRASTR. RES., 1969, 24 : 269-285.

1003539686



37. FANTONE J. C., COLEMAN J. : - The role of the lymphatic system in the clearance of particulate matter from the lungs. In: *Proceedings of the 1966 International Conference on Lung Cancer*, London, 1966, 2 : 755-759.
38. FANTONE J. C., COLEMAN J. : - Interrelation to the histological study of pulmonary metastasis in the lung vascular wall. *ANATOMICAL*, 1967, 4 : 275-281.
39. FRUSCELLI G., SIMONI P. : - Osservazioni sull' ultrastruttura dei vari linfati del ratto. Collettori nasenteriali e condotto toracico. *CELL. SOC. PAUL. EICL. SEER.*, 1970, 45 : 809-812.
40. GEMENT A., FOMERAI M., KOMA H., LIEPAT J., HUSZARI E. : - Vergleichende Untersuchungen über die Innervation der Lymphgefäße. *ANAT. ANZ.*, 1967, 120 : 113-125.
41. GIESSEN R. : - Aufnahme und Ablagerung von Fremdstoffen in der Lunge nach elektronenoptische Untersuchungen. *ERGEN. ALG. PATHOL. PATHOL. ANAT.*, 1953, 32 : 92-126.
42. GONZALEZ-CRUSSI F., BOSTON R.W. : - The absorptive function of the neonatal lung. Ultrastructural study of horseradish peroxidase uptake at the onset of ventilation. *LAB. INVEST.*, 1972, 26 : 114-121.
43. GRAU H. : - Die Lymphgefäße, ein Sonderdrainagesystem der Bindegewebsräume. *WIEN. TIERARZT. WCHS.*, 1955, 52 : 353-359.
44. GROSS P., WESTERICK M.L. : - The permeability of lung parenchyma to particulate matter. *AM. J. PATH.*, 1954, 30 : 195-213.
45. GROSS P., HATCH T. : - Pneumoconiosis : the requirements for lymphatic dust transport. *ARCHIV FUR GEMEINPATH. GEMEINGEHEDE*, 1952, 19 : 660-666.
46. HAPKE E.J., FEDERSON H.J. : - Cytoplasmic activity in type I pulmonary epithelial cells induced by macroaggregated albumin. *SCIENCE*, 1968, 161 : 580-582.
47. HATCH T.E., GROSS P. : - Pulmonary deposition and retention of inhaled aerosols. *ACADEMIC PRESS, NEW YORK*, 1964.
48. HEPFLESTON A.G. : - Disposal on inhaled particulate matter. Unifying hypothesis. *AM. J. PATH.*, 1963, 42 : 119-135.
49. HUMPHREYS P.W., NORMAN I.C.S., REYNOLDS E.O.R., STANING L.B. : - Pulmonary lymph flow and the uptake of liquid from the lungs of the lamb at the start of breathing. *J. PHYSIOL. (LONDON)*, 1967, 193 : 1-29.

1003539687

49. KATZ, H. : - The ultrastructure of the lymphatic system in the lung.  
 GEB. MED. J. N.Y., 1970, 123 : 101-103.
50. KATZ, H. : - The ultrastructure of the lymphatic system in the lung.  
 AM. J. ANAT., 1975, 165 : 449-451.
51. KATZ, H. : - The ultrastructure of the lymphatic system in the lung.  
 J. MICRO. RES., 1975, 106 : 449-451.
52. KATZ, H. : - The ultrastructure of the lymphatic system in the lung.  
 J. MICRO. RES., 1975, 106 : 449-451.
53. KATZ, H. : - Electron microscopic study of the phagocytosis process in lung.  
 J. MICRO. RES., 1975, 106 : 449-451.
54. KATO F. : - The fine structure of the lymphatics and the passage of China ink particles through their walls. I. The fine structure of the lymphatics of cattle lung and the passage of China ink particles through their wall.  
 NAKOYA MED. J., 1956, 12 : 291-295.
55. KATO F. : - The fine structure of the lymphatics and the passage of China ink particles through their walls. II. Electron microscopic findings of the fine structure of the internal thoracic lymphatics of living rabbits and sites of escape of carbon particles from the vessels.  
 NAKOYA MED. J., 1956(a), 12 : 297-299.
56. KLEINMAN X.M.D., KOKOYAMA E.K., - COOK C.D. : - The ultrastructure of the lungs of lambs. The relation of eosinophilic inclusions and alveolar lining layer to fetal maturation and experimentally produced respiratory distress.  
 AM. J. PATH., 1953, 47 : 877-903.
57. KLIKKA E. : - L'ultrastructure des vaisseaux lymphatiques des poumons.  
 C.R. ASSOC. ANAT., 1958, 53 : 1073-1080.
58. KREZ W., DILLERICH H.J. : - Das Lymphgefäßsystem der Niere bei einigen Säugetieren. Licht- und elektronenmikroskopische Untersuchungen.  
 Z. ANAT. HIST. GESCH., 1970, 131 : 111-127.
59. KUBIK I., SZABO J. : - Die Innervation der Lymphgefäße im Mesenterium.  
 ACTA HUNG. ACAD. SCI. HUNG., 1955, 6 : 25-32.
60. KUMI C. : - Cytochemistry of pulmonary alveolar epithelial cells.  
 AM. J. PATH., 1958, 53 : 809-824.
61. KURTEL W. : - Elektronenmikroskopische Befunde am Ductus Thoracicus.  
 Z. ZELLF., 1966, 70 : 519-531.
62. LADMAN A.J., FULTON E.N. : - Electron microscopic observations of pulmonary surfactant and the cells which produce it.  
 ANAT. REC., 1956, 151 : 372 (abstr.).
63. LAU HERRING J.H. et al. : See also 15 : List of publications. - abstr.

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64. LEAK L.V., BURKE J.F. : - The structure of the lymphatic capillary and its junction with the venous system.  
ANAT. REC., 1963, 121 : 502 (abstracted).
65. LEAK L.V., BURKE J.F. : - The structure of the lymphatic capillary and its junction with the venous system.  
AN. J. ANAT., 1963, 123 : 703-710.
66. LEAK L.V., BURKE J.F. : - Special filaments associated with the lymphatic capillary.  
ANAT. REC., 1967, 157 : 276.
67. LEAK L.V., BURKE J.F. : - Electron microscopic study of lymphatic capillaries in the removal of connective tissue fluids and particulate substances.  
IMMUNOLOGY, 1963, 1 : 33-52.
68. LEAK L.V., BURKE J.F. : - Ultrastructural studies on the lymphatic anchoring filaments.  
J. CELL BIOL., 1963(a), 36 : 129-150.
69. LEAK L.V. : - Electron microscopic observations on lymphatic capillaries and the structural components of the connective tissue lymph interface.  
MICROV. RESEARCH, 1970, 2 : 351-361.
70. LEAK L.V. : - Studies on the permeability of lymphatic capillaries.  
J. CELL BIOL., 1971, 50 : 300-323.
71. LEH F.N., SAMPATO H.M. : - The pulmonary alveolar epithelium as an outofermal derivate.  
ANAT. REC., 1957, 127 : 51-63.
72. MCKELIN C.C. : - The pulmonary alveolar mucoid film and the pneumocytes.  
LANCET, 1954, 266 : 1029-1104.
73. KALLER H.C. : - The pulmonary and pleural lymphatics : a challenge to the thoracic explorer.  
J. THORAC. CARDIOV. SURGERY, 1966, 52 : 155-163.
74. MAHMO G., SHEA E.M., LEVENHILL H. : - Endothelial contraction induced by histamine-type mediators. An electron microscopic study.  
J. CELL BIOL., 1959, 42 : 647-672.
75. MELNIKOVA K.V. : - Innervation of the lymphatic vessels of the mesentery of the small intestine.  
ANAT. ANTI. GISTOL. EMEROL., 1964, 46 : 85-91.
76. BLAIR E.C., DOMINGUEZ E.A., RINCH K.E. : - Pulmonary lymphatic and blood absorption of albumin from alveoli. A quantitative comparison.  
LAB. INVEST., 1959, 20 : 1-3.

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76. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
77. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
78. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
79. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
80. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
81. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
82. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
83. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
84. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
85. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
86. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
87. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
88. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.
89. CHURCHILL J. : - *Experiments in the physiology of the lung*.  
LONDON, 1957, 113 : 114-115.

90. CHATFIELD E.H. : - Ultrastructural changes in the pulmonary interstitium in the pathogenesis of the interstitial lung disease.  
 EMER. NEW YORK ACAD. MED., 1978, 44 : 491-495.
91. LEMKE R. : - Ultra hoch elektronenmikroskopische Befunde zur pathogenen Wirkung von Asbest auf mesotheliale Epithelzellen von Mäusen (Grufta Dorechius).  
 EMP. (Basel), 1978, 21 : 323-330.
92. SCHIPP R. : - Feinstruktur besonderer Zellformen in der Lymphgefäßwand und deren Bedeutung für die normale Differenz.  
 J. ULTRASTRUCT. RES., 1967, 19 : 250-259.
93. SCHIPP R. : - Der Feinbau filamentärer Strukturen in Endothel peripherer Lymphgefäße.  
 ACTA ANAT., 1968, 71 : 341-351.
94. SCHNEIDERMAN-KIELEY E.E., KARNOVSKY M.J. : - The ultrastructural bodies of alveolar-capillary membrane permeability to peroxidase used as a tracer.  
 J. CELL BIOL., 1968, 37 : 761-763.
95. SCHNEIDERMAN E.E., KARNOVSKY M.S. : - The influence of intravascular fluid volume on the permeability of newborn and adult mouse lungs to ultrastructural protein tracers.  
 J. CELL BIOL., 1971, 49 : 319-334.
96. SCHWITZ A.L., CRISMER J.T., GRANDE F. : - Absorption of radio-active albumin from the lungs of normal dogs.  
 J. LAB. CLIN. MED., 1963, 61 : 494-500.
97. SCHWITZ A.L., CRISMER J.T., WADA S., GRANDE F. : - Absorption of albumin from alveoli of perfused dog lungs.  
 AM. J. PHYSIOL., 1964, 207 : 1300-1304.
98. SIDANOW D.A., WOLOSKO H.S. : - Die intramurale Innervation des Ductus thoracicus beim Menschen.  
 ACTA ANAT., 1967, 67 : 369-386.
99. SOROKIN S.P. : - Properties of alveolar cells and tissues that strengthen alveolar defenses.  
 ARCH. INTERN. MED., 1970, 125 : 450-463.
100. SUZUKI Y., CHUNG I., SHEH W. : - Phagocytosis of asbestos fibers by epithelial cells.  
 LAB. INVEST., 1968, 18 : 535.

101. DUBLET H., GUTH I. : - Structure and function of the subcutaneous lymphatic system.  
AM. J. ANAT., 1970, 53 : 77-907.
102. SHANN H.C., SPENCER H.B. : - Body salt and water changes during immersion in water desalting.  
GEN. RESP. PHYS. 1970, 1951, 9 : 356.
103. VANDA H. : - The ultrastructure of lymphatic vessels in rabbits and mice.  
AM. J. ANAT., 1971, 152 : 207-215.
104. VANDA J. : - Innervation of lymph vessels.  
ACTA KROM. ACAD. SCI. HUNG., 1966, 19 : 157-203.
105. VANDA J., TOMSEK M. : - The structure of the valves of the lymphatic vessels.  
ACTA KROM., 1971, 73 : 521-531.
106. VAN LIEFDOORN J. : - Est-ce qu'il existe chez l'homme des anastomoses lymphatico-veineuses prévertébrales ?  
PHYSIOLOGIE, 1966, 19 : 51-53.
107. VIRACH S., PAPP M., TORG I., RUSZYK I. : - Cutaneous lymphatic capillaries in dextran-induced oedema of the rat. An electron microscopic study.  
EMER. J. EXP. PATH., 1966, 47 : 553-567.
108. VORWALD A.J. : - Pneumoconiosis : beryllium, hematite fumes, compensation.  
Leroy W. Gardner memorial volume. Paul B. Hoeber Inc., New York, 1959.
109. WANGENSTEEN O.D., WITHERS L.E., JOHNSON J.A. : - Permeability of the mammalian blood-gas barrier and its components.  
AM. J. PHYSIOL., 1959, 216 : 715-727.

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ADDENDUM 2

10. SEPARATE LIST OF PHYSICAL FACILITIES AVAILABLE

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List of physical facilities available

- a) for histology :
  - all routine equipment : drying, covers, rotary microtome Spencer, microtome for large sections Leitz Jung, 3 binocular microscopes, 2 stereomicroscopes.
- b) for radiography :
  - radiographical apparatus Balteau with image intensifier.
  - microradiographical apparatus Baltodyn, Balteau-General Electric.
- c) for histochemistry :
  - cryostat Pearce.
  - freeze-drying apparatus Pearce.
- d) for morphometry :
  - one microscope with lateral projection arm.
  - one Olivetti calculator.
- e) for electron microscopy :
  - one ultramicrotome Porter Blum MT-2.
  - one automatic ultramicrotome Reichert.
  - one vacuum-coating apparatus Edwards.
  - dark room facilities.
  - one freeze-etching ultramicrotome Balzers.
  - one electron microscope Zeiss Em 9 (resolution  $\pm 12$  Å).
  - one electron microscope Philips EM 300 (resolution  $\pm 3$  Å).

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ADDENDUM 3

12. BIOGRAPHICAL SKETCHES

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BIOGRAPHICAL NOTES

- Joseph M. LAURENUS, principal investigator.
- Title and present appointment : M.D., Ph.D. (19), Professor and Chairman of the department of pathology and microscopical anatomy, The Vrije Universiteit, Katholieke Universiteit Leuven-Netherlands, 12, Minderbroedersstraat, B - 3000 LEEUVEN - Belgium.
- Birthdate : R
- Place of Birth : R
- Nationality R
- Family Status : R
- Former Instruction, Degrees, Research Activities and Appointments :
  - Primary School R and Greco-Latin Humanities ( R :
    - Notre-Dame College - Ostend - Belgium and
    - St.- Joseph College - Tielt - Belgium.
    - Official Degrees (Præsumptus and first award of diverse local, provincial and public state examinations).
  - Katholieke Universiteit - Leuven - Faculty of Medicine
    - 12, Minderbroedersstraat
    - B - 3000 LEEUVEN - Belgium.
- 1. Doctor in Medicine ("M.D.")
  - 1951-52 : First Candidature Medicine - July - Magna cum laude
  - 1952-53 : Second " " - July - Cum laude
  - 1953-54 : Third " " - July - Magna cum laude
  - 1954-55 : First Doctorate " " - July - Cum laude
  - 1955-56 : Second " " - July - Magna cum laude
  - 1956-57 : Third " " - July - Magna cum laude
  - 1957-58 : Fourth " " - July - Magna cum laude
- 2. Complimentary Degree of Candidate in Biological Sciences (part.) 1954-55.
- 3. Agrégé de l'Enseignement Supérieur (Ph.D.) (16/05/1962) :
  - Publication of an aggregation thesis, entitled : "De longvaten : hun rol en architectoniek bij de longontplooiing" ; Arsclia, 1962, 302 pg. followed by its public defense (11/04/1962) and
  - a public lecture in the University Promotion Hall : "De anatomopathologie van de long in verband met de perinatale mortaliteit" (16/05/1962).
- 4. "Aspirant" to the "National Belgian Research Funds" 1960-1963.

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5. Fellow of the Association of Specialists in "Pulmonologie" (Clinical Pathology-Section of Medicine / 207) since 1953.
6. Doctor (1952-1957) and Senior Lecturer (Assistant Professor) (1957- ) in histology and pathology at the Faculty of Medicine of the Katholieke Universiteit - Leuven, Netherlands (K.U.L.) since 1952 ; Director of the Department of Histopathology and of the Experimental Laboratory for Cardiopulmonary and Genital Pathology which I founded in 1963 in the Vascular Institute. My special fields of interest are indeed cardiopulmonary and genital pathology. The experimental laboratory belongs to the department of Histopathology.

### Scientific Institutions

I have been working at the Department of Pathology B of the University of Louvain (Dir. : Prof. P. BRUSSELMANS) since 1953 as a student in medicine. From then onward, I have been interested in pulmonary morphology. My first investigations were an experimental and pathological study of the human's lung expansion at birth and of general perinatal mortality and pathology.

Becoming doctor in medicine in 1958, I was appointed "research assistant" in morphology by the University of Louvain and, while working at the same laboratory, put an end to my previous investigation and became "first lauréat" (section of morphology) at the public state competition of the "Bourses de Voyage" 1959, with a "Bijdrage tot het omvormingsmechanisme in de menselijke long bij de geboorte" and in which I stressed for the first time that a "haemodynamic disturbance" could occur in the hyaline membrane disease of the newborn. In 1958, I joined also the Staff of the Laboratory of Anatomy (Prof. G. VAN DER SCHUEREN) and of the Laboratory of Gynaecologic Physiopathology (Prof. H. RENAIER) and have been working there till 1962.

At the laboratory of anatomy, I gained the necessary experience for angio-architectonic studies ; at the laboratory of gynaecologic physiopathology, I could perform the routine pathology of all cases of perinatal mortality (some 100 cases/yearly) occurring at the University clinics. In 1960, I became "Aspirant" at the "Fond National Belge de la Recherche Scientifique" for a period of three years.

Besides routine pathology my special fields of post doctoral research and interest were :

- the vasculature of the lung : histological, angioradiological and angiomicroangiological study of pulmonary and bronchial circulation in man and dog.
- experimental and pathological study of the human's lung expansion at birth.

So I became in 1962 "Agréé de l'Enseignement Supérieur", which is a public state and university degree, more or less corresponding to a "Ph.D.". (Publication

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of anatomical dissection (thesis, entitled: "De longanae longitudo", 1877, 1878, 1879, 360 pages, followed by the publication before the Faculty of Medicine; 1880 is shown in the Examen Roll of the University "De anatomico-pathologie van de long in verband met de pathologische veranderingen").

My military duties were fulfilled in 1959 (July) - 1960 (October) as "sous-lieutenant médecin de réserve" performing, pathology, at the "Central Laboratory of the Royal Military Hospital (LGSB), Brussels, Belgium (Head of the Department: Col. Prad-homme; Cdt. Delporte).

In 1963, I did - as explained under the item "Scientific trips" - during the second semester of the academic year, a stay in the USA (especially at the Armed Forces Institute of Pathology, Washington, D.C.) as "Fellow" of the "World Health Organization".

Finally, I have been appointed in 1962 "dozent" and in 1967 "gewoon hoogleraar" (professor ordinarius in histology and pathology at the University of Louvain (Belgium). As my special fields of interest are "cardiopulmonary and genital", I founded an "experimental laboratory for cardiopulmonary and genital pathology", at the end of 1963. The main work done in this laboratory is a study of the normal and pathological vasculature of the lung by means of radiology, microradiology and histology of the same injected specimens. This work has been supported by a PHS grant HE-00393 (RMD) from the National Heart Institute.

As I had some highly interesting results on the pulmonary arterial vasculature in the newborn, I made a short stay at the Research Center for Premature Infants (Dr. M. KLAUS), Stanford University School of Medicine, Dept. Pediatrics and discussed also these results with Dr. John A. CLEMENTS, Cardiovascular Research Institute, San Francisco, in October 1965. This stay was supported by the University of Louvain and partially by the Stanford University.

I was awarded again a fellowship of the W.H.O. in 1967 for visiting several Universities and research Institutions in the U.S.A. I made a stay of one month at the department of pulmonary and mediastinal pathology (Dr. S. ROSEN) at the Armed Forces Institute of Pathology in Washington, D.C., and of two weeks at the research laboratory of Dr. P. Gruenwald in Baltimore. I made several "guest lectures" (cfr. personal publications - lectures), i.e. at the National Institute of Neurological Diseases and Blindness, at the National Heart Institute, at Case-Western Reserve University (Babies Hospital), at the University of Illinois (Department of Anatomy) and the University of Miami. I visited several prominent research workers in my field of study, i.e. Profs. M.E. AVERY and P. GRUENWALD, Baltimore, Prof. J. CLEMENTS, San Francisco, Prof. M. KLAUS, Cleveland, Prof. J. FAISSEL, Denver, Profs. YANIG

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Since 1957, I have been regularly invited to participate to various international meetings in the U.S.A. (1958 : Second International Congress of Zoology, Miami ; 1960 : Mexican Asian Conference on Physiology ; 1969 : Pacific Asian Conference on Physiology ; 1970 : Cardiovascular Research Institute, San Francisco ; 1971 : Visiting Professor at the University of Southern California, Los Angeles.) and to give several guest lectures as detailed further on in my curriculum vitae.

Special Awards :

- "Lauréat" of the "Prix Specia" 1958.
  - "Lauréat" of the Belgian Public Health Department "Concours de Courses de Voyage" 1959, with a "Bijdrage tot het ontzorgingsmechanisme in de menselijke long bij de geboorte".
  - "First Lauréat" of the "Courses de Voyage Specia 1960".
  - "Lauréat" of the "Prix Ruffin Schoekaert" 1962 for neonatal research activities.
  - Janet Baldwin Memorial Lecturer, 1969, New York (U.S.A.), Lenox Hill Hospital.
  - Amelia Block Memorial Lecturer, 1971, San Francisco (U.S.A.), Mount Zion Hospital.
  - Visiting Professor of Pathology, the University of Southern California, School of Medicine, Los Angeles, California, May 1971.
  - "Lauréat" of the "Prix Dr. G. Scharelhout - Koettlitz" 1968-1970, at the "Koninklijke Vlaamse Academie voor Geneeskunde van België".
  - Visiting Professor of Pathology, Nippon University, Tokyo, Japan, August 1972.
  - Award from the "American Heart Association", March 1973, Tucson, Arizona.
- Academic and Medical Societies :

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Scientific trips and research stases outside Belgium :

- April 1959 : Paris (France) : Laboratory of Pathology (Head of the Department : Dr. Gricouloff) and "Ecole de Puériculture" de la Faculté de Médecine de Paris (Head : Prof. M. Lelong), Université de Paris.
- October 1960 : Paris (France) : "Ecole de Puériculture de la Faculté de Médecine de Paris (Head : Prof. M. Lelong).
- January 1961 : Vienna - Austria : "Anatomisches Institut der Universität" (Head : Prof. H. von Hayek).
- October 1961 : Paris (France) : "Centre d'Etudes et de Recherches des Charbonnages de France" (Head : Prof. P. Policard) "Ecole de Puériculture de la Faculté de Médecine de Paris" Prof. Sarrut).
- 1963 (January-June) : Stay at the "Armed Forces Institute of Pathology" (Prof. Mostofi, Prof. Mahr, Prof. Helwig) in Washington, D.C., U.S.A. as "Fellow of the World Health Organization". Short visit to the Departments of Pathology of University of Illinois Chicago, Ill., Prof. S.R.M. Reynolds ; Harvard Medical School, Boston, Mass., Profs. Hertig J. Craig and P. Young ; Columbia University, New York, N.Y., Prof. W. Blanc ; Yale University, New Haven, Conn., Prof. A. Liebow ; National Institutes of Health, Bethesda, Md., Prof. Stewart ; Participation to the Annual Congress of the "American Association of Pathologists and Bacteriologists" and "International Academy of Pathology" Cincinnati, 26 April- 1 May, 1963 ;

Participation to the "Second Annual Forum for International Medical Scholars-Care," Washington University, School of Med. of Washington - Virginia.

- 1965 (October) : Short stay at the Stanford University School of Medicine ; Stanford Medical Center ; Department of Pediatrics ; Research Center for Premature Infants ; Dr. Marshall Klaus, Palo Alto, California. Side visit to the Cardiovascular Research Institute, University of California, San Francisco.
- 1967 (August 20 - November 5) : Study visit to the U.S.A. as Fellow of the "World Health Organization" at the Armed Forces Institute of Pathology, Department of Mediastinal and Pulmonary Pathology, Dr. S. Rosen ; side visits to the N.I.H., Bethesda, the Case Western Reserve University, the University of Illinois - Chicago and the Jackson Memorial Hospital - Miami.
- 1968 (March) : Invited by the "American Organization Committee" of the "Second International Congress of Lymphology" (Miami, Florida).
- 1968 (June) : Invited by the "Chronic Respiratory Diseases Control Program of the U.S. Public Health Service" to participate at the "Eleventh Annual Conference on Research in Emphysema" in Aspen, Colorado (June 12 - 15). Presentation on the session of "Cell Biology" of "Neonatal Hyaline Membrane Disease : light and electron microscopical studies".
- 1969 (June) : Invited by the "Chronic Respiratory Diseases Control Program of the U.S. Public Health Service" to participate at the "Twelfth Annual Conference on Research in Emphysema" in Aspen, Colorado (June 11 - 14). Presentation on the session of "Lung Morphology" of a lecture : "The lymphatics of the lung : macroscopical and microscopical studies". First "Janet Baldwin Memorial Lecture", Lenox Hill Hospital, New York (June 2) : "Clinical and Pathologic Aspects of Pulmonary Vasculature." Side visit to the Department of Pathology of McGill University, Montreal.
- 1970 (May) : Research stay at "Cardiovascular Research Institute" of the "University of California Medical Center" at San Francisco. Eight International Congress of the International Academy of Pathology, Mexico City (May 11 - 19). Side visit to the Department of Pathology, Duke University School of Medicine at Durham, North Carolina.

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- 1971 ( ) : Visiting Professor of Pathology at the University of Illinois (Chicago) and the University of Arizona (Tucson).  
 He was appointed to "Honorary Amelia Bloch Lecturer" for 1971 at the Mount Zion Hospital (San Francisco). Participated at the Annual Conference of the American Thoracic Society (Los Angeles) and discussed "A stereomicroscopical study of pulmonary lymphatic values".
- 1972 (August) : - Visiting Professor of Pathology at the Nippon University in Tokyo (Japan).  
 We conducted research seminars and held postgraduate lectures on pulmonary and pediatric pathology.
  - Participated at the "4th International Congress for Histochemistry and Cytochemistry", Kyoto (August 21-26).
  - Presentation on the session dedicated to "new methods and techniques" : "The ultrastructure of the lung alveoli using various fixatives and/or Freeze-etching" (in collaboration with Mrs. M. Gombeer Desmecht).
  - Side visits at the universities of Tokyo.
- 1972 (November) : Participant (by invitation) to the "International Conference on Pulmonary Reactions to Organic Materials" New York, U.S.A. November 8-11 1972, organized by "The New York Academy of Sciences" with a contribution on "The Lung lymphatics" (in collab. with J. Baert).
- 1973 (March) : -Invited as "Faculty Member" to deal with the pathology of the lymphatic system at the "Refresher Course in Lymphology", on the "4th International Congress of Lymphology", Tucson (Arizona-USA).
  - As chairman of the Symposium on Heart and Lung Lymphatics, he presented the results of a research project entitled : "The rôle of the lung lymphatics in the transport of intratracheally instilled particles".
  - Finally, he participated as "panel member" at 3 workshops on "Lymphatic Research".
- 1973 (April) : - Participant (by invitation) to the "International Symposium on Microcirculation", Lucerne (Switzerland), April 16-18, 1973, organized by the "European Society of Cardiology" with a contribution on "Morphological Studies of the Blood and Lymphatic Micro-circulation of the Lung".

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1. Lauweryns J. : - Soc. Roy. Belge de Gyn. et d'Obst., BRUXELLES (Belgium), 17/10/1957.  
 - "La mortalité périnatale (cratologie pathologique du fœtus et du nouveau-né)."  
 - In collaboration with Bonte M. and Bonte J.
2. Lauweryns J. : - 46th Congress of the "Association des Anatomistes", MONTPELLIER (France), 23-3-1959.  
 - "Base morphologique de l'érection capillaire du fœtus et du nouveau-né."  
 - In collaboration with Bonte J.
3. Lauweryns J. : - The eleventh "Journées d'Etudes et d'Informations sur le nouveau-né, le prématuré et le nourrisson." Ecole de Puériculture de la Faculté de Médecine de Paris (France), 17-18 October 1959.  
 - "Etude morphologique de l'expansion alvéolaire au moment de la naissance."  
 - In collaboration with Bonte J. and Van Der Schueren G.
4. Lauweryns J. : - 47th Congress of the "Association des Anatomistes", NAPLES (Italy), 26-31 March 1961.  
 - "Documents radiologiques et histologiques sur la circulation bronchique du chien."  
 - In collaboration with Van Der Schueren G.
5. Lauweryns J. : - The twelfth "Journées d'Etudes et d'Informations sur le nouveau-né, le prématuré et le nourrisson," Ecole de Puériculture de la Faculté de Médecine de Paris (France), 16-17 October 1961.  
 - "Le syndrome d'atélectasie pulmonaire secondaire à la naissance, étude morphologique et hémodynamique."  
 - In collaboration with Bonte J. and Van Der Schueren G.
6. Lauweryns J. : - Soc. Belge de Pédiatrie, LIEGE (Belgium), 29-10-1961.  
 - "Possibilités anatomo-cliniques dans le diagnostic des affections respiratoires du nouveau-né."  
 - In collaboration with Eggermont E.
7. Lauweryns J. : - Soc. R. Belge de Gyn. et d'Obst., BRUSSELS (Belgium) Oct-1962.  
 - "Les pneumonies dans la période périnatale. Etude anatomo-clinique."  
 - In collaboration with Eggermont E.

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8. Lauweryns J. : - Soc. Roy. Polpe de Cy. et d'Hist., BRUSSELS (Belgium)  
- Symposium on the "mortalité périnatale d'étiologie obscure"  
"Hémorragies pulmonaires et mortalité périnatale."  
- In collaboration with Fosse J., Fosse J., Fosse J. and  
Candona J.
9. Lauweryns J. : - Soc. Roy. Polpe de Cy. et d'Hist., BRUSSELS (Belgium)  
14-4-1962.  
- Symposium on the "mortalité périnatale d'étiologie obscure"  
"Hémorragies pulmonaires et mortalité périnatale."  
- In collaboration with Eggermont E.
10. Lauweryns J. : - 48th Congress of the "Association des Anatomistes", TOULOUSE  
(France), 15-19 April 1962.  
- "Documents radiologiques et microradiologiques sur la circula-  
tion bronchique et pulmonaire,"  
- In collaboration with Van Der Schueren G.
11. Lauweryns J. : - "American Registry of Pathology", WASHINGTON, D.C. - U.S.A.,  
25-4-1963.  
- "The radiologic appearance of the vessels of the lung."
12. Lauweryns J. : - "Cardiology Clinic, Walter Reed Army Medical Center",  
WASHINGTON, D.C. - U.S.A., 26-4-1963.  
- "The pulmonary circulation."
13. Lauweryns J. : - "Armed Forces Institute of Pathology", WASHINGTON, D.C. - U.S.A.,  
12-6-1963.  
- "The vasculature of the lung."
14. Lauweryns J. : - Second European Congress of Anatomy, BRUSSELS (Belgium)  
1-6th September 1963 - Exposé principal (par invitation)  
(Rapporteur).  
- "L'angioarchitecture du Poumon."
15. Lauweryns J. : - "Société Anatomique de Paris, PARIS (France) 23-4-1964.  
- "La vascularisation pulmonaire."
16. Lauweryns J. : - "Fifth International Academy of Pathology Meeting," LONDON  
(Great Britain), 21-27 June, 1964.  
- "The bronchial circulation and its relationship with the pul-  
monary circulation on the normal dog's lung."
17. Lauweryns J. : - 49<sup>e</sup> Réunion de l'Association des Anatomistes, MADRID (Spain),  
6-10 September, 1964.  
- "Les lymphatiques du poumon néonatal normal et pathologique  
(atélectasie secondaire avec membranes hyalines). Description  
d'une nouvelle technique et résultats."

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18. Lauweryns J. : - 15<sup>e</sup> Journées d'Etudes du nouveau-né, du prématuré et du nourrisson, PARIS (France), 19-20 October 1964.
  - "Essai anatomo-clinique de 35 cas à évolution fatale d'atélectasie pulmonaire méconariale secondaire d'origine obstructive." "
  - In collaboration with Eggermont E., Van den Priecker A. and Denys P.
19. Lauweryns J. : - "Paediatric Pathology Society, the 1965 Meeting, EXETER, 14-16 October 1965.
  - "Neonatal hyaline membrane disease."
20. Lauweryns J. : - Pathology seminar, Stanford University, Medical Center, P.O. BOX 430, ALTO, California - U.S.A., 21-10-1965. Guest Lecture.
  - "A pathological and experimental study of the lymphatics and the vasculature in the respiratory distress syndrome."
21. Lauweryns J. : - "Studiedag betreffende het probleem van de perinatale mortaliteit", Koninklijke Belgische Maatschappij voor Gynaecologie en Verloskunde, de Hogere Medische Raad van het Nationaal Werk voor Kindervelzijn, en de Koninklijke Belgische Maatschappij voor Paediatric, BRUSSELS (Belgium), 13-11-1965.
  - "Perinatal Mortality."
  - In collaboration with Eggermont E., Van den Driessche A., De Coninck Cl., Denys P. and Kenaer H.
22. Lauweryns J. : - "Tweede Nederlandstalig Symposium van het Belgisch Genootschap voor Keelkunde", Main Subject : Pathology of the oesophagus, BRUSSELS (Belgium), 14-11-1965.
  - In collaboration with Morelle J. and Denys P.
23. Lauweryns J. : - Les "Treizièmes Journées d'Etudes et d'Informations sur le nouveau-né, le prématuré et le nourrisson", 15-16-October 1962, PARIS, (France).
  - "La microangiopathie thrombotique du nourrisson."
  - In collaboration with Denys P., Corbeel L. and Van den Driessche A.
24. Lauweryns J. : - De "Vereniging der Nederlandse Gynaecologen en Verloskundigen", 15-12-1962, LIER (Belgium).
  - "Pulmonale afwijkingen en perinatale mortaliteit."

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- "Les hépatites congénitales à caractère familial. Description et individualisation d'une variété nouvelle."
  - In collaboration with Legrand E., Van den Driessche A. and Denys P.
26. Lauweryns J. : - Société Royale Belge de Gynécologie et d'Obstétrique, 5-12-1965, BRUSSELS (Belgium).
- "Deux cas de listériose foeto-placentaire."
  - In collaboration with Knaeer H., Huyghebaert C. and De Brynes P.
27. Lauweryns J. : - II<sup>nd</sup> Symposium on Steroid Hormones, "Androgens in normal and pathological conditions", 17-19 June 1965, GENT (Belgium).
- Dysandrogenic forms of male hypogonadism."
  - In collaboration with Steeno O. and De Voer P.
28. Lauweryns J. : - Société Belge de Pédiatrie en Nederlandse Vereniging voor Kindergeneeskunde, 4-4-1965, LIÈGE (Belgium).
- "Les hépatites congénitales à caractère familial. Description et individualisation d'une variété nouvelle."
  - In collaboration with Denys P., Desmet V. and Dechamps L.
29. Lauweryns J. : - Paediatric Pathology Society, the 1965 Meeting, 14-16 October 1965, EDINBURGH (Great-Britain).
- "Neonatal hyaline membrane disease."
30. Lauweryns J. : - Pathology Seminar, Stanford University, Medical Center, PALO ALTO, California - U.S.A., 21-10-1965 - Guest Lecture.
- "A pathological and experimental study of the lymphatics and the vasculature in the respiratory distress syndrome."
31. Lauweryns J. : - "Studiedag betreffende het probleem van de perinatale mortaliteit", Koninklijke Belgische Maatschappij voor Gynaecologie en Verloskunde, de Hogere Medische Raad van het Nationaal Werk voor Kinderwelzijn en de Koninklijke Belgische Maatschappij voor Paediatric, 13-11-1965, BRUSSELS (Belgium).
- "Pathologische Anatomie in verband met de perinatale sterfte."
  - In collaboration with Eggermont E., Van Den Driessche A., De Coninck Cl., Denys P. and Renner H.
32. Lauweryns J. : - "Tweede Nederlandstalig Symposium van het Belgisch Genootschap voor Heelkunde", gewijd aan de Pathologie van de slokdarm, 14-11-1965, BRUSSELS (Belgium).
- "Pulmonale verwickelingen bij slokdarmatresie : hun mogelijke genesis en hun verloop."
  - In collaboration with Morelle J. and Denys P.

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34. Lauweryns J. : - Internationaal pneumologie colloquium, 18-19-1966, GENEVE (Suisse).  
 - "Desquamatieve interstitiële pneumonie."  
 - In collaboration with Van der Linde L. and De Winter C.  
 - In collaboration with Cosmans J., Gyselen A., Afschrift M. and Roelandt J.
35. Lauweryns J. : - 12th Annual Meeting of the Pediatric Pathology Society, 21-22 October 1966, LONDON (Great-Britain).  
 - "The vasculature of the lung in the neonatal respiratory distress syndrome."  
 - In collaboration with Lerut T. and De Coninck Cl.
36. Lauweryns J. : - Société de Pathologie Thoracique du Nord, 23-10-1966, LILLE (France).  
 - "A propos de deux cas de maladie des colombophiles (pigeon breeder's disease)"  
 - In collaboration with Eyckmans L., Cosmans A. and Wildiers J.
37. Lauweryns J. : - Belgische Vereniging voor Pathologische Ontleedkunde, 19-11-1966, BRUSSELS (Belgium).  
 - "Desquamatieve interstitiële pneumonie."  
 - In collaboration with Cosmans J., Gyselen A. and Afschrift M.
38. Lauweryns J. : - Belgische Vereniging voor Pathologische Ontleedkunde, 19-11-1966, BRUSSELS (Belgium).  
 - "Pigeon breeder's disease."  
 In collaboration with Eyckmans L., Cosmans J., Gyselen A. and Wildiers L.
39. Lauweryns J. : - 52<sup>e</sup> Réunion de l'Association des Anatomistes, 2-6 April 1967, CRÉCY (PARIS) (France).  
 - "L'ultrastructure des vaisseaux lymphatiques pulmonaires."  
 - In collaboration with Boussauw L.
40. Lauweryns J. : - Studiedag van de Belgische Vereniging voor Pathologische Ontleedkunde, 22-4-1967, BRUSSELS (Belgium).  
 - "De pulmonale hyaline membraanziekte van de menselijke pasgeborene."  
 - Reporter General.
41. Lauweryns J. : - Studiedag van de Belgische Vereniging voor Pathologische Ontleedkunde, 22-4-1967, BRUSSELS (Belgium).  
 - "Transpositie der grote bloedvaten met pulmonale recirculatie."  
 - In collaboration with Bourgeois H. and Van Der Hauwaert L.

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42. Lauweryns J. : - "Recherche sur les modifications structurales de l'endothélium vasculaire par microscopie électronique" (Belgium).  
- "The pulmonary lymphatics."  
- In collaboration with Mart A., Boussauw L. and Claessens R.
43. Lauweryns J. : - Annual Meeting of the Association of European Pediatric Cardiologists, 10-13 May 1967, ROMA (Italy).  
- "Ischemic heart failure in infants."  
- In collaboration with Van der Lauwert L. and Boussauw L.
44. Lauweryns J. : - Colloque de Bruxelles de la Société Belge de Microscopie Electronique de la Société Française de Microscopie Electronique, 22-24 May 1967, BRUSSELS (Belgium).  
- "Evaluation au microscope électronique de l'imprégnation neuveuse pulmonaire au tétraoxyde d'osmium-iodure (méthode de Champy-Maillet)."  
- In collaboration with Feuskens J.
45. Lauweryns J. : - "Pneumologie - Colloquium" van de Belgische Vereniging voor de Wetenschappelijke studie van de Tuberculose en de Pneumologie, 1-6-1967, MONT-GODINNE (Belgium).  
- "Abnormale helderheid van een long."  
- In collaboration with Afschrift H., Lacquet A., Cosmans J. and Gyselen A.
46. Lauweryns J. : - "Cardiovascular Research Seminar", Armed Forces Institute of Pathology, 31-8-1967, WASHINGTON (D.C.) - U.S.A.  
- "The electron microscopy of the vascular wall."
47. Lauweryns J. : - 13th Tagung der deutscher Gesellschaft für Elektronenmikroskopie 17-21 September 1967, MÜNCHEN (Deutschland).  
- "The ultrastructure of the pulmonary lymphatics."  
- In collaboration with Boussauw L.
48. Lauweryns J. : - "Guest Lecture" - "National Institute of Neurological Diseases and Blindness", 19-9-1967, BETHESDA (Md.) - U.S.A., National Institutes of Health.  
- "An electron microscopical evaluation of the osmic-acid zinc iodide technique (method of Champy-Maillet) on pulmonary tissue."
49. Lauweryns J. : - "Guest Lecture" - "National Heart Institute", 20-9-1967, BETHESDA (Md) - U.S.A., National Institutes of Health.  
- "Pathological and experimental studies of the alveolar wall, the pulmonary lymphatics and vasculature in the respiratory distress syndrome."

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50. Lauweryns J. : - "Guest Lecture" - Department of Anatomy, University of Illinois, Chicago, Illinois (U.S.A.)  
- "Hyaline membrane disease of the newborn infant."
51. Lauweryns J. : - "Guest Lecture" - Radiology and Chest Disease Department, Case Western Reserve University, 9-10-1967, CLEVELAND (Ohio) - U.S.A.  
- "Hyaline membrane disease of the newborn infant."
52. Lauweryns J. : - "Guest Lecture" - Department of Anatomy-University of Illinois, 12-10-1967, CHICAGO (Ill.) - U.S.A.  
- "The lymphatics of the lung."
53. Lauweryns J. : - "Guest Lecture" - University of Miami School of Medicine, 1-11-1967, MIAMI (Fl.) - U.S.A.  
- "Pulmonary angiography."
54. Lauweryns J. : - "Guest Lecture" - Department of Radiology, Jackson Memorial Hospital, 1-11-1967, MIAMI (Fl.) - U.S.A.  
- "Problems in lymphatic research."
55. Lauweryns J. : - Het vierde Belgisch Nationaal Congres van Pneumologie en Fysicologie en de Belgische Vereniging voor de Wetenschappelijke studie der Tuberculose en der Pneumologie, November 13-16, 1967, BRUSSELS (Belgium).  
- "Asbestlichaampjes in longen van lijken." **1003539709**  
- In collaboration with H. Van de Voorde.
56. Lauweryns J. : - Meeting of the "Belgische Vereniging voor Electronenmicroscopie" 9-2-1967, LOUVAIN (chairman : J.M. Lauweryns).  
- "Electronenmicroscopische studie van de hyaline membraanziekte."  
- In collaboration with N. Bourgeois, M.R. Van Hanne and L. Boussauw.
57. Lauweryns J. : - Second International Congress of Lymphology, March 15-20, 1965, MIAMI (Fl.) - U.S.A. (by invitation).  
- "Radiological and histological studies of the pleural lymphatics."  
- In collaboration with Paert A.L.
58. Lauweryns J. : - Second International Congress of Lymphology, March 15-20, 1965, MIAMI, (Fl.) - U.S.A. (by invitation).  
- "Lung changes in the rabbit after oil embolization."  
- In collaboration with Paert A.L. and Boussauw L.
59. Lauweryns J. : - 11th Aspen Conference on research in emphysema, June 12-15, 1963, ASPEN (Colorado) - U.S.A.  
- "Neonatal hyaline membrane disease : light and electron microscopic studies."  
- By invitation of the Chronic Respiratory Disease Control Program of the United States Public Health Service.

60. Lauweryns J. : - University of Liège, Grand Lecture at the Viterbo of Liège.  
 (Lecture in the Grand Lecture of Liège, March 15, 1971).  
 - Current View and Research concerning the pulmonary lymphatics.
61. Lauweryns J. : - Second International Congress of Lymphology, Miami, Florida,  
 March 15-20, 1963.  
 - "Microscopic and histochemical study of pulmonary lymphatics."  
 - In collaboration with Boussauw L.
62. Lauweryns J. : - Second International Congress of Lymphology, Miami, Florida,  
 March 15-20, 1963.  
 - "Pulmonary lymphatics in some diseases."  
 - In collaboration with Boussauw L., Bourgeois N. and Claessens G.
63. Lauweryns J. : - 53<sup>e</sup> Réunion de l'Association des Anatomistes, TOURS, April, 1961.  
 - "Etude optique et ultrastructurale de l'innervation de papille  
 gustative."  
 - In collaboration with Vanherle G. and Fauskens J.
64. Lauweryns J. : - 53<sup>e</sup> Réunion de l'Association des Anatomistes, TOURS, April, 1961.  
 - "Les phospholipides pulmonaires et leur relation avec le facteur  
 anti-atélectasique : étude histochemique et dynamique."  
 - In collaboration with Boussauw L.
65. Lauweryns J. : - Fourth European Regional Conference on Electron Microscopy,  
 September 1-7, 1968, Rome (Italy).  
 - "An electron microscopical study of neonatal hyaline membrane  
 disease."  
 - In collaboration with Bourgeois N. and Boussauw L.
66. Lauweryns J. : - 14th Annual Meeting of the Paediatric Pathology Society, 25-26  
 October, 1968, ROTTERDAM (The Netherlands).  
 - "Pulmonary ultrastructure in neonatal hyaline membrane disease."  
 - In collaboration with Bourgeois N.
67. Lauweryns J. : - 54<sup>e</sup> Congrès de l'Association des Anatomistes, March 30-April 3,  
 1969, SOFIA (Bulgaria).  
 - "Reconstruction graphique des valvules lymphatiques pulmonaire."  
 - In collaboration with Boussauw L.
68. Lauweryns J. : - 12th Aspen Emphysema Conference, June 11 - June 14 1969, ASPEN,  
 (Colorado) - U.S.A.  
 - "The lymphatics of the lung : macroscopical and microscopical  
 studies."  
 - In collaboration with Burt A. and Boussauw L.

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70. Lauweryns J. : - "Neonatal Lung Disease" - Department of Pathology, Middelheim Hospital, McGill University, June 17, 1969, Montreal, Canada.
- "The idiopathic respiratory distress syndrome of the newborn : light and electron microscopic studies."
71. (81) Lauweryns J. : - 24th session of the "Geneeskundige Dagen van Antwerpen", 16-22 September 1969, ANTWERP (Belgium).
- "Hyaline membranziekte van de pasgeborene" versus "idiopathic respiratory distress syndrome."
  - In collaboration with Bourgeois N.
72. (82) Lauweryns J. : - Boerhaave cursussen voor voortgezet medisch onderwijs, Rijksuniversiteit te Leiden, 27-29 November 1969, in LEXMUN (The Netherlands). General theme : "Physiology and pathology in the perinatal period."
- "Pathologische anatomie van de long in de perinatale periode."
73. (83) Lauweryns J. : - 2nd European Congress of Perinatal Medicine, 8-10 April 1970, LONDON (Great-Britain).
- "The unit lobule : a revised concept of the neonatal lung."
  - In collaboration with Rosen R.C.
74. (84) Lauweryns J. : - 7<sup>e</sup> Congrès International de Microscopie Electronique, 30 August - 5 September 1970, GRENOBLE (France).
- "The freeze-etch ultrastructure of the interalveolar septum of the lung."
  - In collaboration with Gommeer-Desreucht M.
75. (85) Lauweryns J. : - 55<sup>e</sup> Congrès de l'Association des Anatomistes, 22-26 March 1970, NANCY (France).
- "L'ultrastructure de la cloison interalvéolaire de la souris après cryodécapage."
  - In collaboration with Gommeer-Desreucht M.
76. (86) Lauweryns J. : - 55<sup>e</sup> Congrès de l'Association des Anatomistes, 22-26 March 1970, NANCY (FRANCE).
- "L'ultrastructure de l'épithélium bronchique et bronchiolaire de la souris."
  - In collaboration with Cokelaere M. and Bousseaux L.
77. (87) Lauweryns J. : - 8th International Congress of the "International Academy of Pathology, 12-19 May 1970, MEXICO CITY (Mexico).
- "Neonatal hyaline membrane disease : light and electron microscopic studies."

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78. (91) Lauweryns J. : - "Morphological and morphological studies of the human lung in the neonatal period", in *Journal of Pathology and Bacteriology*, 1970, 134, 1-12 (London).
79. (92) Lauweryns J. : - "Morphological studies of the human lung in the neonatal period", in *Journal of Pathology and Bacteriology*, 1970, 134, 1-12 (London).
80. (93) Lauweryns J. : - "Morphological studies of the human lung in the neonatal period", in *Journal of Pathology and Bacteriology*, 1970, 134, 1-12 (London).
81. (94) Lauweryns J. : - Vergadering te LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research" van het INGO, met als thema "De long van de pasgeborene", on 18 April 1970.
82. (95) Lauweryns J. : - Vergadering in LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research" van het INGO, met als thema "De long van de pasgeborene", on 18 April 1970.
83. (96) Lauweryns J. : - Vergadering te LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research" van het INGO, met als thema "De long van de pasgeborene", on 18 April 1970.
84. (97) Lauweryns J. : - Vergadering te LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research" van het INGO, met als thema "De long van de pasgeborene" on 18 April 1970.
85. (98) Lauweryns J. : - Vergadering te LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research", van het INGO, met als thema "De long van de pasgeborene" on 18 April 1970.
86. (99) Lauweryns J. : - Vergadering te LIEVEN van de contactgroep aangaande "Pediatriesch Pathologisch Research" van het INGO, met als thema : "De long van de pasgeborene", on 18 April 1970.

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87. (100) Lauweryns J. : - "De kinder- en jeugdarts" van het "Pediatrisch Pathologisch Instituut" van het I.R.I., als thema "De long van de pasgeborene", op 10 april 1970.
- Anatomopathologische studie van de neonatale hypoxische longaanvalten.
88. (101) Lauweryns J. : - Vergadering van de Nederlandse Vereniging voor Kinder- en Jeugdartsen.
- "Oxygen pollution : its effect on the ecology of lung cells."
- In collaboration with Focan R.C.
89. (102) Lauweryns J. : - Joint Meeting of the "Pathological Societies of Ireland and England", in SHEFFIELD, (England), 10 July 1970.
- "Clinicopathological Aspects of Oxygen Toxicity of the Newborn Human and Animal (Bronchopulmonary Dysplasia).
- In collaboration with Rosan R.C.
90. (103) Lauweryns J. : - Symposium on "The lymphatic system of the heart and lungs" at the Third International Congress of Lymphology, August 27 - September 1, 1970, in BRUSSELS (Belgium).
- "The juxta-alveolar lymphatics of the lung."
91. (104) Lauweryns J. : - Symposium on "The lymphatic system of the heart and lungs" at the Third International Congress of Lymphology on August 27 - September 1, 1970 in BRUSSELS (Belgium).
- "The architecture of the pulmonary lymphatic valves."
- In collaboration with Boussauw L.
92. (105) Lauweryns J. : - Belgische Vereniging voor Pathologische Ontleedkunde.
- "Ultrastructure of the bronchiolar mucosa of the human premature infant."
- In collaboration with R.C. ROSAN.
93. (106) Lauweryns J. : - "Guest Lecture" at the "Department of Pathology" University of CRONINGEN, The Netherlands.
- "De ultrastructuur van de long van de menselijke pasgeborene."
94. (107) Lauweryns J. : - Koninklijk Vlaamse Academie voor Geneeskunde, 17 July in BRUSSELS (Belgium).
- "De ultrastructuur van het interalveolair septum en van het bronchiolair epitheel van de long na vriezen."
95. (108) Lauweryns J. : - "Guest Lecture" at the Department of Medicine, City of Hope Medical Center, May 10th, 1971, LOS ANGELES - U.S.A.
- "The fine structure of the lung lymphatics."

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26. (110) Lauweryns J. : - "Guest Lecture" at the Department of Medicine, Los Angeles County, University of Southern California Medical Center, May 12th, 1971.
  - "Clinical and Experimental Aspects of Lung and Pulmonary Mortality."
27. (110) Lauweryns J. : - "Guest Lecture" at the Department of Medicine, Los Angeles County, University of Southern California Medical Center, May 12th, 1971.
  - "Modern Concepts of Lung Structure, especially the blood and lymphatic microcirculation."
98. (111) Lauweryns J. : - "Guest Lecture" at the Department of Medicine, Los Angeles County, University of Southern California Medical Center, May 13th, 1971.
  - Modern Concepts of Lung structure, especially the airways.
99. (112) Lauweryns J. : - "Guest Lecture" at the Department of Pathology, Hoffman Research Building, University of Southern California, Los Angeles.
  - "Pathologic studies in neonatal hyaline membrane disease and its relationship to the idiopathic respiratory distress syndrome."
100. (113) Lauweryns J. : - "Guest Lecture" Department of Pediatrics, Cardinal Glennon Memorial Children's Hospital, St. Louis University, ST. LOUIS, (Missouri), April 26th 1971. (U.S.A.)
  - "Hyaline Membrane Disease."
101. (114) Lauweryns J. : - "Guest Lecture" at the Department of Pathology, St. Louis University, ST. LOUIS, Missouri, - U.S.A. - April 26, 1971.
  - "Pulmonary lymphatics."
102. (115) Lauweryns J. : - "Guest Lecture" Developmental Pathology Seminar, Department of Obstetrics and Gynecology, University of Chicago Lying-In Hospital, Chicago, ILL., U.S.A., April 29, 1971.
  - "Lung development and perinatal pulmonary pathology."
103. (116) Lauweryns J. : - "Guest Lecture" at the Department of Pathology, University of Arizona Medical Center, May 3, 1971.
  - "The Lung Lymphatics in health and disease."
104. (117) Lauweryns J. : - Amelia Block Memorial Lecturer 1971.
  - Departments of Pathology and Medicine, Mount Zion Hospital and Medical Center, SAN FRANCISCO, California, U.S.A., May 6, 1971.
  - "The lung lymphatics : macroscopic and microscopic studies."

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105. (110) Lauweryns J. : - "The fine structure of the cell in the early stages of the disease" (by invitation).
106. (111) Lauweryns J. : - "The 1971 Annual Meeting of the American Thoracic Society Meeting, LOS ANGELES, California, U.S.A., May 17-19, 1971".
107. (120) Lauweryns J. : - "Guest Lecture" at the Anatomisches Institut der Universität Bern, Switzerland, January 10th, 1972.
108. (121) Lauweryns J. : - "Clinique de Gynécologie et d'Obstétrique de l'Université Libre de Bruxelles - Belgique, 9 February 1972".
109. (122) Lauweryns J. : - "Jaarvergadering van de Belgische Vereniging voor Electronenmicroscopie, 22 March 1972 in LEEUVEN (Belgium)".
110. (123) Lauweryns J. : - "Jaarvergadering van de Belgische Vereniging voor Electronenmicroscopie, 22 March 1972 in LEEUVEN (Belgium)".
111. (124) Lauweryns J. : - "57° Congrès de l'Association des Anatomistes et 22° Réunion de la 'Sociedad de Anatomía Portuguesa', 25-30 March 1972, in LISBONNE (Portugal)".
112. (125) Lauweryns J. : - "57° Congrès de l'Association des Anatomistes et 22° Réunion de la 'Sociedad de Anatomía Portuguesa', 25-30 March 1972, in LISBONNE (Portugal)".

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113. (126) Lauweryns J. : - Faculteit Medica 1971 de Pathologische Anatomie van de Longen in de Universiteitskliniek voor Kinderziekten, 1971.  
- "Pathologische Anatomie van de Pyelische Nierziekten."
114. (127) Lauweryns J. : - 7th Congress of the European Society for Experimental Surgery, 11-14 April 1972, AMSTERDAM (the Netherlands).  
- "Morphological alterations after simultaneous bilateral lung homotransplantation (OLT) under various conditions."  
- In collaboration with Ch.R.H. Vildeveur and Ch. Jorvat.
115. (128) Lauweryns J. : - Vergadering van de Belgische Vereniging voor Pathologische Anatomie, gewijd aan "De niet-tumorale pathologie van de long." BRUSSELS (Belgium), 10 June 1972.  
- "Pulmonary pathology of the newborn."
116. (129) Lauweryns J. : - "Guest Lecture" Department of Pathology, Nippon University, Tokyo - Japan, August 18th. 1972.  
- "Current ideas on the structure of neonatal and adult lung".
117. (130) Lauweryns J. : - "4th International Congress for Histochemistry and Cytochemistry", Kyoto, Japan, August 21-26, 1972.  
- "The ultrastructure of the lung alveoli using various fixatives and/or Freeze-etching".  
- In collaboration with Mrs. M. Gombeer-Desmecht.
118. (131) Lauweryns J. : - "International Conference on Pulmonary Reactions to Organic Materials" New York, November 8-11, 1972, organized by "The New York Academy of Sciences", Chairman Kaye H. Kilburn and Irving J. Selikoff.  
- "The lung lymphatics".  
- In collaboration with J. Baert.
119. (132) Lauweryns J. : - "4th International Congress of Lymphology" Tucson, Arizona, March 6-10, 1973.  
- The rôle of the lung lymphatics in the transport of intratracheally instilled particles.  
- In collaboration with J. Baert.
120. (133) Lauweryns J. : - Vergadering van de "Koninklijke Vlaamse Academie voor Geneeskunde van België", 24 february 1973.  
- "De lymphatische microcirculatie van de long".

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121. (134) Lauweryns J. : - Colloque International d'Histochemie, Tours (France),  
1 - 4 July 1973.
- "Corpuscles Neuro-Epithéliaux de l'épithélium respiratoire des mammifères ; étude histochemique et ultrastructurale.
  - In collaboration with M. Cokelaere and P. Theunynck.
122. (135) Lauweryns J. : - International Symposium on Microcirculation, organized  
by "The European Society of Cardiology", Lucerne  
(Switzerland) 16-18 April 1973.
- Morphological studies of the blood and lymphatic microcirculation of the Lung.

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FRS (G.M. Viallet (1927 - 1981), cardiac physician,

- Form :

**REDACTED**

- Education :

Græco-Latina Humanities - magna cum laude.

University of Leuven - Faculty of Sciences

**R** (July) Licentiate Biologische Wetenschappen ("Master of Biological Sciences") (zoology) - cum laude.

University of Leuven - Faculty of Medicine

Since September **R** free collaborator and since January 1972, full-time university research assistant at the experimental laboratory of cardio-pulmonary and genital pathology.

Monique DESMET is a bright and hard working assistant who has gained precious experience in ultrastructure and in freeze-etching techniques.

- Scientific lectures :

see lectures of Lauweryns, items : 74 ; 75 ; 110.

- Scientific publications :

see publications of Lauweryns, items : (93) ; (97) ; (100) ; (120) ; (122).

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